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Aerial Application in Ohio Agriculture

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CONTENTS

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INTRODUCTION

This publication summarizes findings of a 1966 survey of aerial application activity in Ohio. The findings were obtained through interviews with Ohio aerial applicators and a sample of Ohio farmers, most of whom were users of aerial applicator services.

Aerial application of chemicals, seeds, and fertilizer is widely used in southern and western portions of the United States. Use is limited and selective in the East and Midwest. Limitations on use in these latter areas include crop diversity; small fields of irregular shapes; population density; obstacles such as high-tension lines, towers, aerials, and tree-lined fence-rows; and widespread use of surface application equipment.

This publication reports the extent of aerial application activity in 1965, services rendered, costs of services, and a critique of these services by the sampled farmers. The primary audiences for this publication are the farmers of Ohio and the county agents and extension specialists to whom they turn for information.

THE SAMPLE

The sample area included 15 Ohio counties located in the central and northwestern parts of the state (Figure 1). Census data show that these counties contain 22 percent of Ohio land in farms and generate 24 percent of Ohio cash farm income. The average farm size in this area is 181.6 acres, approximately 24 percent larger than the state average.

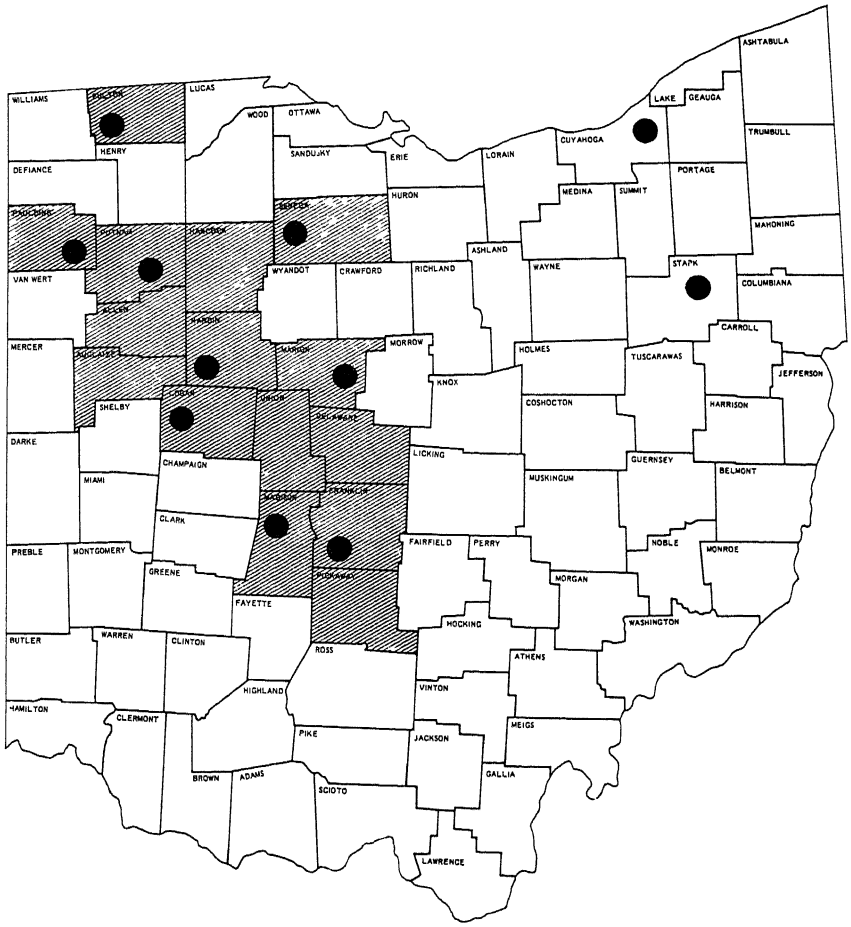
The sampled counties give relatively greater emphasis to field crops, particularly soybeans, and comparatively less emphasis to livestock than the state as a whole. However, livestock provide the largest single source of income, accounting for 57.0 percent of cash farm receipts in the 15 counties. Soybeans, corn and wheat are the leading cash grains, providing 17.1, 12.1, and 5.2 percent of cash farm income, respectively.

The Farmer Sample

The sample consisted of 24 farmers operating 60 farm tracts totaling 12,230 acres. These farmers treated 3,530 acres by aerial application in 1965.[1] The average farm tract was 205 acres. The average

[1]The figure includes acres which were treated more than once.

Fig. 1.—Sample area and location of aerial applicators, Ohio, 1966.*



*Location of aerial applicators indicated by dots. Cuyahoga and Stark County operations began after completion of survey. Source: survey data.

farmer operated 509 acres and operations ranged in size from 175 to 1400 acres and from 1 to 14 tracts.

With the exception of two farmers with no prior experience with aerial application, the sample was selected from customer lists provided by aerial applicators. The sample constituted 1 percent of aerial application customers and 3 percent of total acreage treated by aerial application in Ohio in 1965.[2]

[2]In addition, one respondent, a professional farm manager, managed more than 40,000 acres. This acreage was not included in averages cited above.

TABLE 1.—Characteristics of Applicators in the Sample.

Age, Education, Experience	Average	Range
Years of Age	45.2	40-54
Years of Education	12.4	8-16
Years of Flight Experience	20.1	10-26
Total Flight Hours	6,056	800-15,000*
Flight Hours per Year	284.5	80.0-600.0†
Years of Agricultural Application Experience	13.0	6-17
Application Flight Hours	3,400	1,300-8,000‡
Application Flight Hours per Year	261.5	100.0-533**
Percent Total Flight Hours in Application	56.1	13.3-84.2
Percent Having Farm Experience	55.5	———

*Refers to owner of firm, perhaps not himself an agricultural pilot.
†Averaged over total years as a pilot.
‡Includes hired pilots.
**Averaged over years as an agricultural pilot.

The Aerial Applicator Sample

No two aerial applicators were located in the same county, although aerial application activity in Ohio in 1965 was largely confined to the northwestern part of the state (Figure 1).[3]

Applicators were seasoned pilots, averaging 20.1 years of flying experience in which they had logged an average of more than 6,000 flying hours. More than half of this flight time had been acquired while engaged in aerial application. Only two of the applicators had been military pilots. Experience with aerial application ranged from 6 to 17 years and averaged 13 years.

More than half of the applicators had personal farming experience and four of the nine were actively engaged in farming in 1965 (Table 1). Only four of the nine applicators regularly derived the majority of their income from aerial application and only one was engaged solely in aerial application. Other activities undertaken by applicators included flight instruction, air charter, aircraft rental and maintenance, and airport operations, as well as farming.

AERIAL APPLICATION ACTIVITY IN OHIO IN 1965

Job Characteristics

Applicators estimated the number of acres of various treatments which could be realized per hour under optimum conditions, such as field size and shape, minimum ferry distance, etc.[4] Estimates ranged

[3]Figure 1 shows counties in which farmers and applicators were interviewed. All aerial applications in Ohio in 1965 were not confined to these counties, however.

[4]These estimates reflect the performance characteristics of the airplane, such as speed, maneuverability, load carrying capacity, availability and speed of ground loading equipment, and the skill of the individual operator in minimizing the time spent in all support functions.

TABLE 2.—Aerial Applicator Estimates of Job Completion Rates Under Optimum and Typical Conditions, Acres per Hour, Ohio, 1966.

Application Job	Crops Cited	Acres per Hour*				Typical as Percent of Optimum
		Optimum†		Typical‡		
		Average	Range	Average	Range	
Seeding	Legumes, grains and grasses	103.3	60-130	61.5	40-100	59.5
Fertilizer (dry)	Grains	60.3	27-120	42.4	25-60	70.3
Fertilizer (liquid)	Grains, sugar beets	131.7	120-150	66.7	50-90	50.6
Pesticide - Fungicide	Legumes, grains and other**	135.8	50-360	79.6	30-200	58.6
Herbicide	Grains	88.8	40-150	56.3	25-80	63.4
All Operations (estimated)		107.4	27-360	64.1	25-200	59.7
All Operations (actual, 1965)††				38.8	22.2-63.2	36.1

*Variations in estimates may not reflect differences in opinion among applicators so much as differences in aircraft types used by them and differences in application rates and characteristics of materials applied

†Ideal conditions in terms of ferry distance, absence of obstacles, shape and size of fields, etc., and not necessarily limited to conditions characteristic of Ohio.

‡Typical Ohio conditions, relative to optimum conditions above.

**Included tomatoes, potatoes, tobacco, orchards, and Christmas trees.

††See Table 3.

TABLE 3.—Extent of Aerial Application Activity by Nine Aerial Applicators, Ohio, 1965.*

Size of Operation	Total	Average	Range
Number of Agricultural Aircraft Operated	14†	1.4	1-4
Applicator Flight Hours‡	3,025	336.1	100-900
Aircraft Flight Hours**	3,025	232.7	100-300
Acres Treated by Applicators†	117,400	13,044	5,000-25,000
Acres Treated by Aircraft**	117,400	9,030.8	5,000-18,000
Acres Treated per Flight Hour	———	38.8	22.2-63.2

*Interviews conducted in 1966 concerning last full year of business activity (1965).
†One aircraft was used only as a reserve during 1965. Measures of central tendency and dispersion in this table are based on 13 aircraft.
‡Per applicator or firm (9).
**Per aircraft (13).

from less than 30 up to 360 acres per hour and were directly related to weight of material dispensed per acre (Table 2). Average of all optimum estimates was 107.4 acres per hour.

Applicators were asked to contrast these estimates with their estimates of typical aerial application conditions encountered in Ohio. These estimates were much more conservative, averaging only 64.1 acres per hour. But even these estimates proved to be optimistic when compared with the actual rate of 38.8 acres per hour realized in 1965 (total acres treated divided by total hours flown, Tables 2 and 3).

Scope of Aerial Application Operations in 1965

Aerial applicators interviewed treated 117,400 acres in Ohio with 13 airplanes in 1965 (Table 3). These planes flew a total of 3,025 hours and averaged 232.7 hours each. An average of 38.8 acres were treated per hour, including ferry time and loading time.

Acres treated per firm ranged from 5,000 to 25,000 and averaged 13,044 acres per firm. For individual airplanes, acres treated ranged from 5,000 to 18,000 and averaged 9,031 per plane. Six firms each operated only one airplane and one of the multi-plane operators kept one airplane in reserve. Based on operator estimates of acres treated and aircraft hours flown, the range of acres flown per hour varied from 22.2 to 63.2.[5]

The aircraft most frequently used by Ohio applicators were Piper Pawnees and Piper Super Cubs. Five Pawnees and four Super Cubs were in operation in 1965, together with a Snow, a Callair, a Grumman Ag Cat, and two Piper Cubs.

[5]Compared to a national average of 68.3 acres per hour, none of the Ohio agricultural aircraft appear to be achieving productivity equal to their potential.

TABLE 4.—Summary of Most Common Aerial Application Work Completed by Nine Aerial Applicators, Ohio, 1965.

Crop	Percentage of Aerial Applicator Sample Doing Work	Total Acres Reported	Application Rate per Acre Average	Application Rate per Acre Range	Price Charged per Acre Average	Price Charged per Acre Range
				Fertilizer		
Corn	44.4	3,800	137.5 lb.	75-250 lb.	$1.42	$1.25-1.50
Soybeans	66.7	15,500	2.7 gal.	2-5 gal.	1.50	2.50
Wheat	100.0	5,750	130.4 lb.	60-300 lb.	1.67	1.25-2.00
Other*	22.2	100	2.0 gal.	2 gal.	1.50	1.50
				Insecticides and Fungicides		
Corn	88.9	8,800	2.4 gal.	1.5-4 gal.	$1.50	$1.50
Potatoes	22.2	6,000	6.0	2-10	1.38	1.25-1.50
Other*	44.4	3,050	3.86	.125-10 gal.†	1.75	1.50-2.50
				Herbicides		
Corn, Oats, and Wheat	55.6	9,340	3.75 gal.	2-10 gal.	$1.42	$1.25-1.75
				Seed		
Legumes and Grasses	100.0	23,100	41.4 lb.	6-120 lb.	$1.20	$ .85-2.00
All Other Work	100.0	40,460				
		117,400			$1.40‡	$ .85-2.50

*Sugar beets, tomatoes, orchards, tobacco, Christmas trees, etc.
†.125 gallons per acre application of undiluted Malathion.
‡Weighted arithmetic mean.

Application rates employed in 1965 were extremely varied, ranging from 8 oz. to 300 lb. per acre. Lightest dispensing rates were used with carbamate pesticides, while the heaviest rates of application were for dry fertilizer applied in wheat and corn (Table 4).

Charges for application varied but were closely related to the weight of material dispensed per acre. Generally, legume and grass seeding had the lowest weight per acre applied and the lowest price per acre charged. Dry fertilizer frequently had an additional "1 cent per pound applied" to the base price quoted (Table 4). This charge reflected the decrease in aircraft productivity (acres per hour) caused by the increase in the number of loads of material required to treat a field of given size.

Typical Ohio Operations

The average Ohio job described by aerial applicators was 34.5 acres located 17.3 miles from the home base. Material was dispensed

TABLE 5.—Aerial Application Job Characteristics, Described from Past Experiences by Nine Aerial Applicators, Ohio, 1966.

Job Characteristics Experienced by Ohio Aerial Applicators	Mean	Range
Number of Acres		
Largest	422.2	100-1,600
Smallest	3.0	0.9-5.0
Typical	34.5	20-60
Ferry Distance (miles)*		
Longest	44.2	15-150
Shortest	0.3	0.0-2.0
Typical	6 7	1-10
Distance from Base (miles)†		
Longest	115.8	15-200
Shortest	0.3	0.0-2.0
Typical	17.3	7-35
Swath Length (feet)		
Longest	4,562	2,600-5,280
Shortest	253	100-660
Typical	1,420	1,280-1,600
Application Rate (lb. per acre)		
Heaviest	183.8	100-300
Lightest	7.9	0.5-15.0
Typical	18.2	12-25

*Distance in miles between job location and point where aircraft lands for reloading and refueling.

†Distance in miles between applicator's home airport and job locations.

at the rate of 18.2 lb. per acre in a swath approximately ¼ mile long (Table 5). Based on the average number of acres treated per hour as reported by all operators, the average job would require 53 minutes of actual application time, including support functions.

Restrictions and Precautions Employed by Aerial Applicators

All applicators cited some conditions under which they would not accept jobs or preferred not to do them (Table 6). Wind velocity was a unanimous restriction, while type of material and distance from home were also common. The possibility of herbicides drifting into nearby crops and the health hazard involved in using highly toxic organic phos-

TABLE 6.—Selected Judgments and Operating Procedures of Nine Aerial Applicators.

On what basis do customers request service?	Regularly	70%
	Emergency	20%
	Occasionally	10%
What restrictions do you place on your services?	Material*	70%
	Minimum field size†	0%
	Distance from base‡	89%
	Rate of application**	56%
	Wind velocity††	100%
How do you determine rates and charges?	Cost plus profit	44%
	Competitor's price	56%

With what degree of accuracy can you place?	Spray	Dry Material
Excellent (within 1 foot of edge)	78%	70%
Good (within 10 feet of edge)	0%	20%
Poor (more than 10 feet from edge)	22%	10%

What type of liability insurance do you carry?	Customer	Customer's Neighbors
Crop	44%	44%
Livestock	33%	33%
Other property	67%	56%
Personnel	56%	56%
None	22%	22%

*Included references to herbicides, sulfur, and highly toxic organic phosphates.

†Some operators indicated distance would affect size of job accepted.

‡Half of operators citing a restriction had a limit of 25 miles, the other half had a limit of 150 miles.

**Liquid restrictions ranged from 2 to 10 gal. per acre Dry material restrictions ranged from 150 to 200 lb. per acre.

††Maximum for spray ranged from 5 to 12 miles per hour, while maximum for dry materials was 5 to 15 miles per hour of 90 degree crosswind

phates were reasons given for these restrictions. Other responses were qualified, generally to the effect that almost any limits to field size, distance, or rate of application would be waived if the customer was willing to bear additional cost or if the job could be fitted in conveniently with work for other customers. Applicators frequently expected the farmer to supply the material to be dispensed and encouraged farmers to be present to witness the application.

Accuracy of Placement of Material

Generally, applicators felt accuracy was good (within 10 feet) to excellent (within 1 foot) at field edges. Poor accuracy was encountered most frequently when opening or closing the flow of material at field and swath ends. Field-end accuracy problems were handled by flying one or more clean-up swaths across each end of the field. Field edge accuracy was affected mostly by crosswind, thus causing the restriction on wind velocity imposed by all operators (Table 6).

Guarantees

Eight of the nine applicators were willing to guarantee their work as far as coverage was concerned. Two were willing to guarantee results based on the fact that they were using specialized equipment and with the provision that they were supplied the proper material to apply at the correct time.

AERIAL APPLICATION CUSTOMERS IN OHIO IN 1965

Characteristics of Farm Operations in the Sample

Farmer respondents in this study reported crop production patterns which conformed closely to production patterns for total agriculture in the northwestern part of Ohio. They showed few characteristics which would make their requirements for aerial application unique relative to other farmers in the surrounding area (Table 7).

Most farmers in the sample regarded corn as either a principal or a secondary crop. Soybeans and wheat also were maior income-producing crops. Some respondents showed a high degree of specialization. For example, growers of potatoes and sugar beets consistently regarded those crops of primary or secondary importance.

References to certain management practices indicated that northwestern Ohio farmers use methods which are important to aerial applicators. For example, confinement feeding of livestock, removal of fences and hedgerows, and similar practices tend to increase field size, remove dangerous obstacles, promote specialized and intensive cropping programs, and restrain concentrated livestock populations in small areas. Farmers generally were well informed concerning soil types and

TABLE 7.—Crops Raised and Crop Acreage Among Farmer Respondents, Ohio, 1965.

Crop	Percent Farmers Raising Crop	Number of Acres in Sample			Number of Fields in Sample			Average Acres per Field
		Total	Average per Respondent	Range	Total	Average per Respondent	Range	
Corn	95.7	4,459	202.7	25-800	166	7.6	2-25	26.9
Wheat	87.0	1,080	54.0	15-150	51	2.6	1-5	21.2
Soybeans	65.2	2,198	145.5	15-540	107	7.1	1-20	20.5
Oats	34.8	280	35.0	7-90	23	2.9	1-6	12.2
Rye	17.4	74	18.5	5-44	11	2.8	1-6	6 7
Hay	56.5	641	49.3	12-110	35	2.7	1-4	18.3
Potatoes	17.4	224	56.0	15-83	18	4.5	2-7	12.4
Sugar Beets	17.4	268	67.0	53-89	16	4.0	3-6	16.8
Tomatoes	4.4	3	3.0	3	1	1.0	1	3 0
Orchard Crops	4.4	30	30.0	30	1	1.0	1	30.0
Diverted	82.6	1,116	58.7	15-220	59	3.1	1-7	18.9
Total		10,373*			488			21.3

*Excludes other miscellaneous crops and wastelands.

requirements and were knowledgeable about optimum cropping systems, management practices, and crop and soil requirements which would maximize returns from their resources.

Summary of Farmer Experiences with Aerial Application

Sampled farmers contracted aerial application treatment for 3,530 acres in 1965 (Table 8). The most common work category was herbicide, insecticide, or fungicide spraying and corn was the crop most frequently treated. Fertilizing, mostly on corn, also was an important aerial service.

Most applications occurred at a time when surface application was a feasible alternative. However, about one-fourth of the aerial applications occurred under conditions not suitable to surface application.

Farmers judged the results of aerial application to be satisfactory in the majority of cases (Table 8). Applications in corn were consistently judged to be satisfactory but varied judgments were made about the effectiveness of aerial applications to other crops. Insecticides, fungicides, and herbicides appeared to give satisfactory results with few exceptions. Seeding of grasses and legumes resulted in satisfactory responses in 75 percent of the cases, with marginal seeding conditions identified as responsible for some of the remaining 25 percent judged to be unsatisfactory.

Costs of Aerial Application

Application charges typically were applied on a per-acre basis and did not include material costs. An additional 1 cent per lb. applied frequently was charged for dry fertilizer applications (Table 8). All job rates averaged $1.17 per acre but ranged widely from $0.80 to $3.00 per acre. Most rates above $2.00 were associated with fertilizer applications. Seeding and spraying jobs averaged less than $1.50 and about half the seeding jobs were done for less than $1.00 per acre.

Some bargaining between farmers and applicators entered into price determination. This was evident in differences between prices quoted by applicators and prices which farmers reported that they paid (Table 9). However, prices reported by both applicators and farmers for jobs other than fertilizing averaged lower than surface application rates for comparable jobs in that same year. The base price for liquid or dry fertilizer applications, however, averaged 50 to 60 percent higher than surface application prices (Table 9).

Concluding Judgments of Farmers

Aerial application is not directly comparable to surface application in terms of advantages and disadvantages. When such a comparison was attempted, farmers gave widely varied responses (Table 10).

TABLE 8.—Summary of Experiences with Aerial Crop Treatments Among Farmer Respondents.

Crop	Total Acres Treated	Ground Application Feasible*		Judgment of Results		
		Yes	No	Excellent	Satisfactory	Unsatisfactory
		Fertilizer				
Corn	656	71.4%	28.6%	14.3%	87.7%	0.0%
Soybeans	330	80.0%	20.0%	20.0%	60.0%	20.0%
Wheat	206	80.0%	20.0%	0.0%	100.0%	0.0%
Other†	66	100.0%	0.0%	33.3%	66.7%	0.0%
		Insecticide and Fungicide‡				
Corn	779	66.7%	33.3%	0.0%	100.0%	0.0%
Potatoes	194	80.0%	20.0%	0.0%	100.0%	0.0%
Sugar Beets	208	100.0%	0.0%	0.0%	100.0%	0.0%
Other**	70	50.0%	50.0%	0.0%	50.0%	50.0%
		Herbicide				
Corn	274	100.0%	0.0%	0.0%	100.0%	0.0%
		Seeding				
Grasses and Legumes	566	62.5%	37.5%	50.0%	25.0%	25.0%
Wheat	181	50.0%	50.0%	25.0%	75.0%	0.0%
All Crops, All Jobs	3,530	72.3%	27.7%	4.0%	88.0%	8.0%

*The question is concerned with whether or not an alternative to aerial application was available when the job was done.
†Mostly potatoes and orchards.
‡Usually applied together.
**Mostly peas and legumes.

TABLE 8. (Continued)—Summary of Experiences with Aerial Crop Treatments Among Farmer Respondents.

Crop	Total Acres Treated	Acres per Farmer		Cost per Acre	
		Average	Range	Average	Range
		Fertilizer			
Corn	656	93.7	3-170	$1.34	$1.00-1.50
Soybeans	330	66.0	20-160	1.14	1.00-1.35
Wheat	206	41.2	15-65	1.12	1.00-1.35
Other†	66	22.0	10-40	1.17	1.00-1.50
		Insecticide and Fungicide‡			
Corn	779	129.8	9-200	$1.33	$1.00-3.00
Potatoes	194	38.8	10-83	1.00	1.00
Sugar Beets	208	69.3	53-89	1.00	1.00
Other**	70			1.25	1.00-1.50
		Herbicide			
Corn	274			$0.93	$0.85-1.00
		Seeding			
Grasses and Legumes	566	70.8	25-200	$1.31	$0.85-3.00
Wheat	181	45.3	30-60	0.88	0.80-1.00
All Crops, All Jobs	3,530	70.6	3-200	$1.17††	$0.80-3.00††

†Mostly potatoes and orchards.
‡Usually applied together.
**Mostly peas and legumes.
††Plus 1c per pound applied in some cases.

TABLE 9.—Summary of Dollars per Acre Charged for Aerial and Surface Agricultural Applications, Ohio, 1965.

Reporting Sources	Seeding	Fertilizing* Dry	Fertilizing* Liquid	Insecticides, Fungicides	Herbicides
Aerial Application Charges Reported by Applicators					
Average	1.15	1.57	1.50	1.66	1.42
Range	0.75-2.00	0.75-3.00	1.50	1.25-2.50	1.00-1.75
Charges Reported by Farmers					
Average	1.17	1.21	1.31	1.16	0.93
Range	0.80-3.00	1.00-1.50	1.00-1.50	1.00-3.00	0.85-1.00
Surface Application Published by Ohio State University†					
Typical	2.00	1.00	1.00	2.00	2.00
Range	1.50-3.00	1.00-2.00	1.00-2.00	1.00-2.50	1.00-2.50
Aerial as a Percent of Surface‡	57.5	157.0	150.0	83.0	71.0

*Fertilizer prices reported often are base (shown) plus 1 cent per pound applied.

†Source: Shaudys, E. T. and R. H. Baker. 1966. Farm Custom Rates Paid in Ohio, 1965. Ohio Coop. Ext. Serv., Leaflet 74.

‡Based on charges reported by aerial applicators (top row) divided by published surface charges (second row from bottom row). It should be noted that these two sets of rates are not directly comparable. Aerial rates are averages while surface rates are typical (or model) charges. Direct comparisons may be made between quoted ranges in prices, however.

Nearly half of the farmers felt that, all things considered, results obtained from aerial application were about the same as could be realized from surface application. More than 30 percent felt that aerial application results were better and another 20 percent thought they were worse.

Reasons for these differences of opinion are found in the variety of work conditions experienced, the variety of jobs that aerial applicators performed, and variations in crops and levels of crop maturity under which jobs were completed. Placement accuracy is more difficult to achieve, for example, with fine droplet sprays than with heavy, granular applications. Moreover, placement accuracy is less critical for some jobs than for others, such as the application of legume seeds vs. application of toxic sprays. Thus, if placement accuracy is critical, surface application may present advantages which cannot be matched. Then aerial application may be employed only under conditions of imperative need in which surface application is not feasible and work conditions may not be conducive to good results by any method. Farmers were aware of the advantages of aerial application when speed and timeliness were critical (Table 10).

TABLE 10.—Selected Attitudes and Judgments About Aerial Application.

Item	Percentage Distribution of Responses				
Results Obtained Compared to Surface Application	Better 32.4	Same 47.0	Worse 20.6		
Placement Accuracy at Edge of Field	To the Edge 46.7	Within 10 ft. 23.2	Within 20 ft. 20.0	More than 20 ft. 10.0	
Advantages of Aerial Application	Speed and Timeliness 42.8	No Wet Ground Problem 18.4	No Crop or Ground Damage 18.4	Cost Saving 16.3	Other* 4.1
Reservations About Using Aerial Application	None 53.9	Toxic Drift 19.2	Coverage† 11.5	Other‡ 15.4	

*Included ability to get at difficult locations, benefits from air agitation, etc.

†Concerns about completeness, uniformity, accuracy of coverage, and whether the agreed-upon amount and type of material were actually being applied.

‡Included concerns about costs, liability, pilot safety, etc.

Under other sets of conditions, aerial application possesses advantages which cannot be matched by surface application, such as the treatment of mature crops with minimum crop damage, applications over wet ground, and the ability to get at difficult locations. These capabilities also were identified by farmers (Table 10).

In summarizing their judgments, most of their satisfaction rested in speed and timeliness, minimum crop damage and ground compaction, uniformity of coverage, and calibration accuracy. Most of their dissatisfaction was concerned with placement inaccuracy (Table 11).

SUMMARY

Aerial application is a custom service rendered in competition with other custom operators offering similar services with surface application equipment.

Wet spring planting conditions and the epidemic spread of insects and diseases are the most common problems which have caused farmers

TABLE 11.—Farmer Judgments of Advantages and Disadvantages of Aerial Application Compared to Surface Application.

Characteristics of Aerial Application	Advantage	Disadvantage
Cost: (total)	20	5
General statements	5	5
Labor savings or equipment savings	15	0
Satisfaction with results: (total)	50	17
General statements	4	1
Application accuracy	11	6
Calibration accuracy	6	0
Placement accuracy at edges (wind drift)	5	6
Application uniformity or completeness	10	6
Desirable blast or agitation effect	2	4
Equipment effects	23	0
Crop damage	5	–
Ground compaction	18	–
Timeliness: (total)	47	0
General statements	16	–
Wet ground	23	–
Mature crop treatment	8	–
Speed: (total)	20	0
Other: (total)*	18	4
Total	155	26

*Included judgments of desirable or undesirable effects on crop such as palatability to livestock, moisture content, nutrient content, etc., and other miscellaneous comments such as convenience, fairness of treatment, reaction of neighbors, and general observations about the experiences of others.

to employ aerial applicators for the first time. Many become repeat customers, with applicators and farmers reporting that about 75 percent of aerial application activity in Ohio is for regular customers.

Sampled farmers explained why they liked aerial application. It was fast and not limited by wet surface conditions or crop maturity. Therefore, it permitted timely treatment. The method did not cause ground compaction or crop damage at field ends and it permitted treatment in fields difficult to reach on the ground.

About 80 percent of these farmers believed that the results obtained from aerial treatments were easily as good as those which could have been realized with surface application equipment. But this judgment was tempered with qualifications about job conditions, crops involved, and treatments to be applied.

Some farmers felt they received better calibration and more even coverage from aerial seeding of grasses and legumes. Other farmers, speaking of control agents for diseases and insects, thought treatment coverage was less complete than from surface application. Some farmers said the blast effect of surface spray rigs was necessary for complete coverage. Other farmers argued that the turbulence created by low-flying aircraft resulted in complete coverage.

Placement accuracy of materials dispensed by aerial applicators varies widely. Seventy percent of the farmers thought the applicator could be depended upon to get the material within 10 feet of the field boundary. Ten percent doubted that he could get it within 20 feet of the boundary. Again, job conditions and the materials used affected these responses.

Application accuracy is sometimes easiest to obtain on jobs when inaccuracy is least harmful, as in seeding grasses, grains, and legumes, and accuracy may be hardest to obtain under conditions where accuracy is critical, as in application of fine-droplet toxic sprays. Consequently, the greatest single worry expressed by either applicators or farmers was concern for drifting toxic materials.

Most applicators carried liability insurance, all of them placed restrictions on job conditions they would accept, and most placed some restrictions on materials they would handle and apply. However, within the limits of these restrictions, rates charged by applicators for their services were competitive with surface application custom rates and some aerial applicators guaranteed their work.

The State Is the Campus for Agricultural Research and Development

Ohio's major soil types and climatic conditions are represented at the Research Center's 11 locations. Thus, Center scientists can make field tests under conditions similar to those encountered by Ohio farmers.

Research is conducted by 13 departments on more than 6000 acres at Center headquarters in Wooster, nine branches, and The Ohio State University.

Center Headquarters, Wooster, Wayne County: 1918 acres

Eastern Ohio Resource Development Center, Caldwell, Noble County: 2053 acres

Mahoning County Experiment Farm, Canfield: 275 acres

Muck Crops Branch, Willard, Huron County: 15 acres

North Central Branch, Vickery, Erie County: 335 acres

Northwestern Branch, Hoytville, Wood County: 247 acres

Southeastern Branch, Carpenter, Meigs County: 330 acres

Southern Branch, Ripley, Brown County: 275 acres

Vegetable Crops Branch, Marietta, Washington County: 20 acres

Western Branch, South Charleston, Clark County: 428 acres